UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

MAR 31 1999

REPLY TO THE ATTENTION OF

SR-6J

Mr. Thomas V. Skinner, Director
Illinois Environmental Protection Agency
1021 N. Grand Avenue East
P.O. Box 19276
Springfield, IL 62794-9276

Re: Central Illinois Public Service Company Site, Taylorville, Illinois Five-Year Review Report

Dear Mr. Skinner:

The U. S. Environmental Protection Agency (U. S. EPA) has reviewed the Five-Year Review Report prepared by the Illinois Environmental Protection Agency for the subject site. The report is hereby approved.

U. S. EPA appreciates the efforts of Gerome Willman of your staff in conducting this review. Please feel free to contact me if you have any questions.

Sincerely,

William E. Muno, Director
Superfund Division

FIVE-YEAR REVIEW REPORT
CENTRAL ILLINOIS PUBLIC SERVICE COMPANY SITE
TAYLORVILLE, ILLINOIS

Prepared By:
Illinois Environmental Protection Agency for
U.S. Environmental Protection Agency
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William E. Muno, Director
Superfund Division

3/31/99

Date

FIVE-YEAR REVIEW REPORT
CENTRAL ILLINOIS PUBLIC SERVICE COMPANY SITE
TAYLORVILLE, ILLINOIS

I. PURPOSE

The Illinois Environmental Protection Agency ("Illinois EPA") has conducted a five-year review at the Central Illinois Public Service Company Superfund Site ("CIPS site") in Taylorville, Illinois. Section 121 (c) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 ("CERCLA"), as amended, and section 300.430 (f)(4)(ii) of the National Oil and Hazardous Substances Contingency Plan ("NCP") require that periodic reviews (no less than every five years) be conducted at sites where the selected remedial action results in hazardous substances, pollutants, or contamination remaining at the site above levels that allow for unrestricted exposure and unlimited use. The purpose of the five-year review is to confirm that the selected remedial action continues to be protective of human health and the environment.

This report is intended to document the completion of the five-year review at the CIPS site. A statutory review with Level I analysis was conducted as outlined within U.S. EPA's OSWER Directives 9355. 7-02 and 7-02A entitled "Structure and Components of Five-Year Reviews" and "Supplemental Five-Year Review Guidance", respectively. The CIPS site was not eligible for a Level Ia analysis because the site was placed within the Construction Completion Category on October 6, 1995.

A copy of this five year review is being placed in the repository for the Site at the Taylorville Public Library, which is located at 121 West Vine in Taylorville, Illinois.

II. SUMMARY OF SITE CONDITIONS

A. Site Background

The CIPS site is located in Christian County at 917 South Webster Street in Taylorville Illinois. The site is owned by the Central Illinois Public Service Company ("CIPS") and is slightly less than one acre in size. The site is bordered on the north by typical residential block arrangements. On the south, the site is bounded by Seaman Estates subdivision which consists of eight large wooded tracts with single family residences on several. All of the tracts surround Seaman Estates Pond which is also directly south of the site. To the east is Manners Park which is the City's main multi-use facility. The site is bounded immediately on the west by the CIPS pole yard and railroad tracks. Figure 1, taken from Hanson Engineers' July 1995 Contractor Quality Control Plan, displays the site's location. The figure was slightly modified to better identify the location of the Seaman Estate Pond. In addition, Figure 2 taken from John Mathis and Associates' May 1991 Risk Assessment and Feasibility Study Update, exhibits the site's layout.

A Manufactured Gas Plant operated on the site from 1883 to 1932. In 1932 the plant closed and most of the above-ground structures were torn down while the below-ground tanks were apparently filled with debris and left in place (Hanson Engineers, Phase I).

filled with debris and left in place (Hanson Engineers, Phase I).

Contamination was discovered at the site by a septic tank contractor on October 20, 1985 (Cochran). CIPS notified the Illinois EPA and the company began an on-site investigation. The contaminants on-site were identified as coal tar and its constituents. Coal tar is a byproduct of the coal gasification process and is comprised mainly of polynuclear aromatic hydrocarbons ("PAHs") such as naphthalene and benzo(a)anthracene as well as volatile organic compounds ("VOCs") such as benzene and toluene.

The site is underlain by a largely unconfined aquifer which moves from a northeast to southwest direction through fairly well sorted sand and gravel. This sand and gravel aquifer extends to approximately ninety (90) feet below ground surface where it is underlain by bedrock comprised of limestone and dolomite. The uppermost geologic unit is loess, a wind blown material which ranges from 5 to 10 feet in depth. The loess consists of very fine sand, silt and clay that allows recharge of the aquifer from the surface. The water table beneath the site is approximately 15 feet below ground surface (Hanson Engineers, Phase II).

B. Results of Site Characterization

1. Soil Sampling

The soil investigation at CIPS consisted of sampling at the ground surface as well as subsurface sampling. Between November 1985 and September 1986 a total of 33 soil borings were conducted, 13 on-site, and 20 off-site. The soils investigation identified soil contamination from PAHs and VOCs. Contamination was identified within the site boundaries as well as within a smaller area consisiting of a drainage swale, directly south of the site. Contamination on-site was concentrated near the center of the site surrounding a buried brick tank which was used to store coal tar. On-site soils near the tank were highly contaminated and contained pockets of tar to depths near 10 feet below ground surface. The drainage swale to the south of the site consisted of a drainage area which lead to the Seaman Estate Pond. Contamination was identified to depths of approximately 4 feet within the drainage swale south of the site which lead to the Seaman Estate Pond (Hanson Engineers, Field Investigation). With the exception of the the drainage swale, all off-site borings in the immediate vicinity of the site had no detectable levels of PAHs (Hanson Engineers, Phase II).

2. Sediment and Surface Water Sampling

Sediment samples were taken at 59 off-site locations between April and September of 1986. Elevated levels of PAHs were identified within the drainage swale immediately south of the site. Lower levels of contamination (below 2 parts per million "ppm") were identified within the Seaman Estate Pond and along the draw from the pond to the South Fork of the Sangamon River (Hanson Engineers, Field Investigation).

In conjunction with the 1986 sediment investigation, surface water samples were taken at a total of

18 locations. Surface water samples focused mainly on the drainage way south of the site and the Seaman Estate Pond. In addition to the pond and drainage way, the draw from the pond to the South Fork of the Sangamon River, as well as the river itself, were sampled. Organics were only identified at three locations, 0.9 parts per billion ("ppb") being the highest for any PAH (Hanson Engineers, Field Investigation).

3. Private Well Sampling

Twenty-two domestic wells were sampled as a part of the Phase II program between March and August of 1986. Domestic well locations are identified on Figure 3 taken from Hanson Engineers' December 1986 Phase II Site Investigation and Remedial Alternative Development Report. The wells were tested for PAHs and VOCs. PAHs were identified within four of the wells at low levels which were less than 0.031 ppb phenanthrene in most cases (John Mathis). VOCs in the form of chlorinated hydrocarbons were also detected within these wells. The location of the wells, and the detection of contaminants not related to the site, lead CIPS to believe that the contamination was likely from a source other than the site (Hanson Engineers, Field Investigation).

4. Groundwater Sampling

A total of fifteen groundwater monitoring wells were installed between November 1985 and August 1986 (Hanson Engineers, Field Investigation). Four wells were installed on-site and eleven were installed off-site. See Figures 3 and 4 taken from Hanson Engineers' December 1986 Phase II Site Investigation and Remedial Alternative Development Report. Total PAHs detected in on-site wells (GW-3, GW-4, and GW-7) ranged from 8,676 ppb to 2,665 ppb, while total PAHs in off-site wells were all less than 1 ppb (Hanson Engineers, Phase II). The total concentrations of benzene, ethyl benzene, toluene, and xylene ("total BETX") in on-site wells (GW-3, GW-4, and GW-7) ranged from 17,180 ppb to 7,100 ppb while total BETX in off-site wells was less than 15 ppb (Hanson Engineers, Phase II).

III. SUMMARY OF RESPONSE ACTIONS

A. Immediate Removal Actions

In response to a notice issued by Illinois EPA, CIPS began an immediate removal action at the site on January 19, 1987. Above and below-ground structures associated with the gas plant were removed. On-site contaminated soil was removed to an average of ten feet below ground surface. Approximately 9,000 cubic yards of contaminated soil was removed and transported to Peoria Disposal Company Landfill for disposal. Additionally, an area of approximately 600 feet by 50 feet was excavated from the drainage swale running off-site towards the Seaman Estate Pond. The depth of the off-site excavation averaged about three feet. A total of 3,000 cubic yards was excavated from the drainage swale and transported to Peoria Disposal Company Landfill for disposal. The excavation was completed in March of 1987. The excavations were filled with clean soils from off-site (Illinois, Record). The purpose of the removal action was to remove the source material which posed a principal threat to human health and the environment. Figure 2 displays the extent of excavations within the "main area" and "Area A" south of the site. The off-site excavation within Area A addressed all off-site sediments impacted by the site which posed a human health risk outside of U.S. EPA's acceptable risk range. Reasonable Maximum Exposure scenarios for all sediments south of the site yielded hazard indexes less than one and cancer risk levels less than 7.53×10^{-6} for every type of sediment exposure (John Mathis).

No additional off-site excavation was required. As discussed within sections II.B.1, 20 soil borings were conducted surrounding the facility at off-site locations. None of the samples taken from the borings immediately surrounding the site had detectable levels of PAHs. As provided within Hanson Engineer's <u>Work Plan for Providing Phase II Site Investigation and Remedial Alternative Development</u>, representative samples from regular intervals (2.5 to 5 feet) were classified by the field geologist and screened with organic vapor analysis. No odors or visual observations of contamination were noted for vadose zone soils within any of the borings immediately surrounding the site (Hanson Engineers, <u>Field Investigation</u>). As such, no vadose zone samples were analyzed within the laboratory for individual PAHs. Field scientist's observations confirmed the expectation that with the exception of sediments south of the site, off-site soils were not impacted because surface drainage flowed **onto** the site from the east, west and northerly directions. Presumably, the lack of contamination within off-site soils (with the exception of sediments within the drainage swale) prompted risk managers to exclude these locations from further evaluation within the risk assessment.

As a part of the removal action, CIPS extended a water main to five properties south of the site in order to provide home owners with municipal potable water and remove those residents from private well water. The water main loop was completed in October 1987. In December of 1988, CIPS extended the on-site fence surrounding the site to adjacent properties to the south in order to further restrict access to the site (John Mathis).

<u>B. Institutional Controls</u>

In addition to the removal action conducted in 1987, CIPS took several actions to further protect human health and the environment until a final remedy could be implemented. Institutional Controls that were implemented include:

- Purchase of two large parcels south of the site and placement of deed restrictions to prohibit use of groundwater on the properties; and
- Placement of deed restrictions on five properties south of the site in the Seaman Estate Pond Development to prohibit groundwater use (John Mathis).

<u>C. Construction and Continuous Operation of a Groundwater Pump and Treat System</u>

1. Plant Construction

In February of 1994, CIPS began on-site construction of the Pump and Treat System. The system was designed and built according to approved design specifications with only two minor deviations from the original plans. The primary components of the system are:

- Two 16 inch diameter extraction wells extending to the base of the surficial aquifer (approximately 90 feet);
- Two vertical turbine pumps capable of pumping groundwater at process flow rates from 200 to 500 gallons per minute ("gpm");
- Addition of sulfuric acid to reduce pH and prevent scaling followed by addition of potassium permanganate to aid in iron removal;
- Filtration by 3 in-line bag filters, followed by two in-line vessels charged with Granular Activated Carbon; and
- On-site discharge of treated water south of the site (Hanson Engineers, Remedial Action).

2. Operation and Maintenance

Operation and Maintenance for the system is being conducted based on information presented within the February 1995 document entitled Equipment Operation and Maintenance Data for Ground Water Pump and Treat System Volumes 1 -6 which was prepared for CIPS by Roy F. Weston, Inc. CIPS has contracted Professional Services Group, Inc. to operate the facility (Hanson Engineers, Remedial Action).

Initially, project personnel were concerned over the system's inability to precipitate iron and collect it within the plant's bag filters. Variations in the chemistry of extracted groundwater resulted in varying degrees of iron removal within the bag filters. Currently, the carbon columns are successfully removing the iron to meet effluent standards. As a result of utilizing the carbon columns to remove iron, the columns have required additional back washing. CIPS plans to continue to remove iron within the carbon columns until groundwater chemistry within the area stabilizes (Hanson Engineers, Remedial Action).

Since start-up in February of 1995, additional maintenance has been required for the two extraction wells on-site. In October of 1996, CIPS reported to the Illinois EPA that they believed that the East Extraction well was plugged by iron fouling bacteria, resulting in a decrease in the pumping rate. In February 1997, both wells were cleaned using a sonar jet, followed by hydrochloric acid and a trade name product consisting of an organic acid. In addition, potassium hydroxide was used because tar was suspected to be causing some extraction difficulties as well. However, as of June 1997, the east recovery well's production rate began to drop again. As previously indicated, coal tar surrounding the east extraction well has occasionally limited its operation parameters. Although an evaluation by Hanson Engineers showed that hydraulic containment could be achieved with a pumping rate as low as 50 gpm, the west well will continue to operate at 250 gpm and the east well at its maximum of 125 gpm. (Richardson, Third Quarter). On March 17, 1998, a contractor for CIPS began a biological treatment for the east well. The biological treatment involved the addition of two pounds of a commercial bacteria mixture per day for 58 days. The biological treatment process was only partially successful, and another chemical treatment was conducted, this time utilizing hydrochloric acid, potassium hydroxide, and citrus extract. The latest treatment was more successful, allowing the east well to operate at process levels around 125 gpm (Richardson, telephone).

D. On-going Monitoring

1. Monitoring of Pump and Treat System Discharge

The monitoring program established for the pump and treat system consists primarily of influent samples taken immediately following extraction, and effluent samples prior to discharge to the environment. The sampling program was more vigorous during plant start-up and stabilization, and tapered off as operations became routine. Hanson Engineers' Contractor Quality Control Plan outlines the sampling program and effluent limitations for the pump and treat system. Currently, plant influent and effluent are being sampled on a weekly basis for PAHs, BETX, pH, and iron.

2. Groundwater Monitoring

CIPS has conducted annual groundwater monitoring since the groundwater sampling program was instituted in 1988 (John Mathis). Following the construction of the pump and treat system, CIPS implemented the groundwater monitoring plan outlined within Hanson Engineers' Contractor Quality Control Plan. Groundwater samples are analyzed primarily for the constituents identified as clean up objectives within the Record of Decision ("ROD"). In general, monitoring wells adjacent to, and within the Groundwater Management Zone ("GMZ") are sampled quarterly while wells further down gradient are sampled on an annual basis.

3. Seaman Estate Pond Study

Beginning in 1989, and continuing to the present, CIPS and its contractors, have conducted an annual study of the Seaman Estate Pond (Hanson Engineers, Remedial Action). The study includes surface water sampling, sediment sampling, and fish tissue studies. Sediment, surface water, and fish tissue are analyzed for priority PAHs. In addition fish tissue is analyzed for pesticides and polychlorinated biphenols ("PCBs"). Tables 1, 2, and 3 (attached) are taken from QST Environmental Incorporated's Final 1997 Annual Report Seaman Estate Pond Study and identify the priority PAHs and pesticides which were detected in fish tissue, sediment, and surface water taken from the pond from 1989 through 1997. Concentrations within all three media (i.e. fish tissue, sediment and surface water) are sporadic and show no apparent trends (QST Environmental).

IV. REMEDIAL OBJECTIVES

A. Immediate Removal Actions

On July 2, 1986, Illinois EPA issued notice to CIPS pursuant to section 4(q) of the Illinois Environmental Protection Act requesting that CIPS undertake the following actions under the State removal program:

- Locate and identify all buried structures at the site:

- Sample and analyze the contents of underground structures as well as soil surrounding such structures; and,

- Devise and submit a plan for removal of underground structures and contaminated soil in order to prevent and mitigate the migration or the release of hazardous substances, pollutants or contaminants from the site (Illinois EPA, Notice).

Hanson Engineers' December 1986 document entitled "Work Plan For Immediate Removal" specified how CIPS and its contractors would meet the requirements set forth within the 4(q). The Work Plan stated that all above and below-ground structures would be excavated and removed. Regarding contaminated soil, the Work Plan stated that soil would be removed to two feet below the base of the under-ground tank used as a tar holder, and to 10 feet below ground surface in areas where soil borings exhibited elevated PAHs. The excavations were filled with clean soils from off-site (Illinois, Record). This area is shown within Figure 2 taken from Mathes and Associates' May 1991 Risk Assessment and Feasibility Study Update.

No numerical objectives were identified for the immediate removal. The overall objective was to remove the source material to levels several feet below ground surface in order to minimize the threat or potential threat to human health and the environment. The Immediate Removal Action was undertaken with the understanding that it would be followed by additional investigation and potentially, further remedial actions. Written correspondence from 1988 from Illinois EPA confirmed that the Immediate Removal Action, if followed by groundwater treatment, was sufficient (Child). The removal of soils and source material, municipal water-line hook-up, and on-site fencing continues to serve its intended purpose, that of reducing continual discharges to groundwater and reducing the potential for exposure to surficial and groundwater contamination.

B. Institutional Controls

The institutional controls at the site, in the form of deed restrictions, continue to be in effect for all the properties (Richardson, telephone). Therefore, the deed restrictions continue to serve their intended purpose and are protective of human health and the environment.

C. Construction and Continuous Operation of a Groundwater Pump and Treat System

The primary objectives of the pump and treat system were identified within Hanson Engineers' 1989 document Groundwater Pump and Treat System Basis of Design Report and reiterated in the ROD. The primary objectives for the system include: 1) To prevent contaminants from migrating off-site; 2) To remove contaminants from extracted groundwater to levels suitable for surface water discharge; and, 3) To eventually cleanse the aquifer to levels which no longer present a threat to public health (Illinois EPA, Record).

1. Prevent Contaminants From Moving Off-Site

Hanson Engineers' Groundwater Pump and Treat System Basis of Design Report states that "Data from the ground water modeling studies performed by HEI *(Hanson Engineers Incorporated)* indicated that pump rates ranging from a minimum flow of 200 gallons per minute (gpm) to a maximum flow of 500 gpm are predicted to be needed for hydraulic containment (Hanson Engineers)" (*added text*). The pump and treat system has been designed and operated to meet these parameters. Pressure transducers were installed within wells surrounding the extraction wells to determine hydraulic gradient and to ensure containment.

On December 1, 1997, Hanson Engineers submitted a report to CIPS evaluating hydraulic containment at the site. The report concludes that with discharge to the Seaman Estate Pond, hydraulic containment can be achieved with pumping rates as low as 50 gpm. Illinois EPA determined that Hanson's data did not conclusively demonstrate hydraulic containment at pumping rates of 50 gpm. CIPS indicated within its October 23, 1997 Third Quarter Report that the west well will continue to operate at 250 gpm and the east well at its maximum of 125 gpm (Richardson, Third Quarter). Additionally, as discussed previously, CIPS has attempted to maintain the east extraction well through cleaning to allow for rates higher than 125 gpm. The plant has been running continuously (except for minor interruptions) since July 10, 1995. From July of 1995 through October 31, 1998 the plant pumped and treated 340,288,845 gallons, averaging 195 gallons per minute.[1] Illinois EPA believes that the pump and treat system continues to maintain hydraulic containment thereby arresting migration of contaminants and protecting human health and the environment as envisioned within the ROD.

2. Groundwater Treatment Prior to Discharge

The groundwater which is extracted by the pump and treat system contains concentrations of contaminants which must be treated prior to discharge. The ROD established average and daily maximum contaminant concentrations which the treatment system must achieve meet before releasing the water to the environment. Table 4, which is based on the ROD is attached. Table 4 is taken from Hanson Engineers' July 1995 Contractor Quality Control Plan.

Throughout 1998, 1997, and most of 1996, the treatment system at CIPS has consistently been able to achieve the clean-up objectives for the extracted groundwater prior to discharge. However, on several occasions during the first six months of operations, concentrations of benzene within the effluent exceeded discharge limitations. The majority of the instances when discharges of benzene were in excess of the 50 ppb standard were due to slugs of tar entering the system (Richardson, January 24, 1996). CIPS believes that the free product coated the walls and nozzles within the carbon vessels, and that even after removing the spent carbon, the tar continued to leach off of the vessel causing spikes of benzene in the discharge. Benzene concentrations during the periods in August, September, December and early January when discharges were out of compliance averaged

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1 Average flow rate calculated using data from monthly summaries submitted to Illinois EPA by CIPS.

around two to three times the standard but peaked as high as ten times the standard.[2] In January of 1996, CIPS revisited its operating procedures to reduce the potential for discharges to occur in excess of the standards. In consideration of the relatively short periods of time in which effluent concentrations have been exceeded, and the low level of contamination, overall performance of the treatment system has been satisfactory. Since January 1996, the treatment system has operated well. In consideration of these matters, Illinois EPA believes that the treatment system currently meets the objectives set forth within the ROD.

In addition to the surface water discharge limits set within the ROD, the Seaman Estate Pond Annual Monitoring Program ensures that the remedial action continues to be protective through an intensive monitoring of surface water, fish tissue and sediment within the pond. Tables 1, 2, and 3 (attached) are taken from Hanson Engineers' <u>Final 1997 Annual Report Seaman Estate Pond Study</u> and identify the priority PAHs and pesticides which were detected in fish tissue, sediment, and surface water taken from the pond from 1989 through 1997. Concentrations within all three media (i.e. fish tissue, sediment and surface water) are sporadic and show no apparent trends. In connection with the Risk Assessment, the ROD states that 0.119 mg/kg of total carcinogenic PAHs in fish tissue corresponds to a carcinogenic risk of 1.0×10^{-5} (Illinois EPA, <u>Record</u>). The risk level of 1.0×10^{5} falls within U.S. EPA's acceptable risk range. Utilizing the assumptions within the Risk Assessment, fish tissue concentrations for carcinogens identified within the Risk Assessment and their corresponding risks have remained below 1.0×10^{-5} from 1989 through 1997. Data for 1998 is not yet available.

3. Aquifer Restoration

The ROD established groundwater clean-up objectives that when attained, would no longer present a threat to public health. Table 4 (attached) identifies clean-up objectives for the groundwater. Each of the chemicals listed within Table 4 have been identified within the groundwater beneath the site. Tables A, B, and C below, compare groundwater concentrations of three compounds within three shallow on-site wells.

TABLE A	**GW-7** (concentrations in ppb)									
	CUO	4/94	4/95	12/95	5/96	11/96	5/97	11/97	5/98	11/98
Benzene	5	5.7	23	2.0*	2.0*	29.6	2.0*	83.7	2.0*	2.0*
Naphthalene	25	21.4	24.7	1.6	.8	37.9	1	2.2	3.3	.9
Anthracene	2100	6.56	<6.6	.79	6.6*	6.6*	6.6*	6.6*	6.6*	6.6*

TABLE B	**GW-3** (concentrations in ppb)									
	CUO	4/94	4/95	12/95	5/96	11/96	5/97	11/97	5/98	11/98

[2] Data compiled from monthly influent/effluent reports submitted to Illinois EPA by CIPS.

Benzene	5	2,700	499	110	116	30	18	26.2	125.2	8.6
Naphthalene	25	918	2400	4860	2500	362	318	362	984	123.7
Anthracene	2100	9.9	8.01	4.23	6.6*	6.6*	6.6*	6.6*	6.6*	6.6*

* Compound not detected above Project Acceptable Detection Limit which is shown.

TABLE C	**GW-16S** (concentrations in ppb)									
	CUO	4/94	4/95	12/95	5/96	11/96	5/97	11/97	5/98	11/98
Benzene	5	115	446	132.3	30.7	2.0*	2.0*	2.0*	2.0*	2.0*
Naphthalene	25	1.7	113	71.4	50.8	16.7	5.6	2.2	.6	0.6*
Anthracene	2100	.014	<6.6	6.6*	6.6*	6.6*	6.6*	6.6*	6.6*	6.6*

* Compound not detected above Project Acceptable Detection Limit which is shown.

The wells within Tables A, B, and C were chosen based on proximity to the extraction wells (GW-7 being the closest to the center of the site, GW-16S being the most distant). See Figure 5, taken from Hanson Engineers' July 1995 Contractor Quality Control Plan. Benzene, Naphthalene, and Anthracene were chosen from the entire list of contaminants for use within the tables, because of their prevalence within the groundwater. In addition, the three chemicals' physical characteristics are representative of the wide range of chemical solubility, vapor pressure, etc. which coal tar's constituents possess. Temporary fluctuations in contaminant concentration such as those identified within Tables A and B for GW-7 and GW-3 on 11/97, could potentially be the result of a "slug" of contaminated groundwater passing by the wells on the way towards the point of extraction. Monitoring well data for all on-site wells indicate that the pump and treat system is progressing towards the goal set within the ROD, "To eventually cleanse the aquifer to levels which no longer present a threat to public health (Illinois EPA, Record)". The pump and treat system is performing as envisioned within the ROD and facility design documents. However, groundwater monitoring data indicates that clean-up objectives have not been met throughout the aquifer. In order to meet the requirements set forth within the ROD and remain protective of human health and the environment, the pump and treat system must continue its current operation.

V. APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) REVIEW

Five year review guidance and policy require Illinois EPA and U.S. EPA to review and analyze the ARARs established for the site to ensure that they remain protective. In addition, guidance requires that any newly promulgated or modified Federal or State environmental laws which affect the remedial action be considered.

A. ARARs Identified Within the ROD

ARARs Identified within the ROD and expounded upon within Hanson Engineers' Groundwater Pump and Treat System Basis of Design Report are listed below.

> National Oil and Hazardous Substances Pollution Contingency Plan at Title 40, Code of Federal Regulations ("CFR") Part 300.
>
> Safe Drinking Water Act ("SDWA") National Primary Drinking Water Standards at 40 CFR 141. This portion of CFR lists the Maximum Contaminant Levels ("MCLs") which are allowed within municipal drinking water systems.
>
> Clean Water Act ("CWA") Ambient Water Quality Criteria at 40 CFR 122 and National Pollutant Discharge and Elimination System ("NPDES") requirements at 40 CFR 125.
>
> Illinois Environmental Protection Act at 415 ILCS 5/1 et seq.
>
> Illinois Groundwater Quality Standards at Title 35, Illinois Administrative Code ("IAC") Subtitle F and Surface water Quality Standards at 35 IAC Subtitle C.
>
> Clean Air Act ("CAA") National Ambient Air Quality Standards at 40 CFR 50 and National Emission Standards for Hazardous Air Pollutants at 40 CFR 61.
>
> Resource Conservation and Recovery Act ("RCRA") definition and identification of hazardous wastes at 40 CFR 261 and 35 IAC 721.
>
> RCRA requirements for generators and transporters of hazardous wastes at 35 IAC 722 and 723 and RCRA requirements for owners and operators of hazardous waste treatment, storage and disposal facilities at 35 IAC 724.
>
> Air Pollution Prevention requirements at IAC Subtitle B.
>
> Occupational Safety and Health Administrative ("OSHA") regulations governing health and safety for workers involved in hazardous waste operations at 29 CFR 1910.120 and general construction regulations at 29 CFR 1926.

The Groundwater Pump and Treat System Basis of Design Report also identified criteria "to be considered" within the remedial action. The To Be Considered Criteria ("TBCs") include the following:

> The SDWA's proposed MCLs and final and proposed goals ("MCLGs") at 40 CFR 141; and,
>
> Risk derived levels for drinking water or discharge exposures for contaminants with no ARARs or TBCs.

The remedial action at the site continues to comply with the narrative and numeric requirements within the NCP, OSHA and the Illinois Environmental Protection Act, and these ARARs continue to remain protective.

The pump and treat facility was designed and continues to be operated in accordance with RCRA

ARARs. Contaminated filter media, and personal protective equipment continue to be analyzed, shipped and disposed of in accordance with RCRA and State solid waste regulations. Spent carbon taken from the carbon treatment columns from within the facility are taken off-site by the service contractor for re-generation, and re-use back at the CIPS facility.

No changes have occurred at the Federal level to the CAA or at the State level within 35 IAC Subtitle B that call into question the protectiveness of the remedy.

The remedy's past compliance with the CWA as well as the State's surface water regulations was discussed previously within Section 4.C above, entitled "Construction and Continuous Operation of a Groundwater Pump and Treat System". Surface water numerical standards which will be utilized to monitor the remedial action in the future are discussed within Section V.B <u>Numerical Clean-up Objectives Identified within the ROD</u>. In addition to the requirements set forth within the CWA, the Seaman Estate Pond Annual Monitoring Program ensures that the remedial action continues to be protective through an intensive monitoring of surface water, fish tissue and sediment within the pond.

With regard to groundwater, the remedial action continues to comply with the SDWA as well as the State's 35 IAC 620 regulations. As discussed within the ROD, a Groundwater Management Zone ("GMZ") has been instituted at the site based on the regulations at 35 IAC 620.250. The remedy continues to meet the requirements necessary for a GMZ to remain in effect. Groundwater numerical standards which will be utilized to monitor the remedial action in the future are discussed within the section below.

<u>B. Numerical Clean-up Objectives Identified within the ROD</u>

1. Groundwater

The clean-up objectives set forth within the ROD for groundwater were based on the drinking water regulations at 40 CFR 141 and 35 IAC 620, including any proposed standards, as well as risk based criteria. Any revisions to 40 CFR 141 and 35 IAC 620 were compared to levels set within the ROD. In addition, all new criteria utilized by the State of Illinois based on risk were also reviewed. Thorough evaluation indicated that the levels set within the ROD for groundwater restoration continue to be protective. Since the ROD was signed in September of 1992, MCLs have been established at .0002 mg/L and .005 mg/L for benzo(a)pyrene and dichloromethane respectively. The table below compares the newly promulgated levels to those established within the ROD.

Compound	ROD Objective	Newly Promulgated MCL
benzo(a)pyrene	.00023 mg/L	.00020 mg/L
dichloromethane	.0002 mg/L	.05 mg/L

No change to the ROD are necessary based on the newly promulgated MCL for dichloromethane.

Since the MCL is higher than the clean-up objective set within the ROD, the original standard will be continue to be utilized. However, the newly promulgated MCL for benzo(a)pyrene is lower than the clean-up objective set within the ROD. Calculations performed using the site's approved risk assessment indicate that the standard set within the ROD (.00023 mg/L) remains protective, and therefore, will not be changed.

2. Surface Water

Clean-up objectives set within the ROD for surface water focuses on concentrations of contaminants within the treated water to be discharged (i.e. effluent limitations) as well as concentrations of a surface water body which are protective. The effluent limitations and surface water quality concentrations set forth within the ROD are the same for each contaminant because the ROD assumes the discharge occurs into a stream with no existing flow. Clean-up objectives set within the ROD for surface water are contained within Table 4 (attached). Toxicity data taken from the scientific literature along with formulas from within 35 IAC Part 302 were utilized to calculate the maximum allowable concentrations set forth within the ROD. However, since September of 1992, toxicity information has became available for compounds which previously had no data, and in addition, the toxicity data for a number of compounds has changed. In order to ensure that the requirements set within the ROD continue to be protective, surface water quality standards were re-calculated utilizing any new toxicity information for the contaminants of concern. Table 5 identifies the newly calculated standards. Illinois EPA considers the new numbers to be more precise and to more accurately reflect concentrations which will protect human health and the environment because new and more accurate toxicity data has been utilized within its calculations. Therefore, Illinois EPA shall require the effluent from the pump and treat facility to meet all new standards where the concentration is lower than that identified within the 1992 ROD.

VI. SUMMARY OF SITE VISIT

On March 1, 1999 the project manager conducted a site visit for the purposes of the five year review. Site fencing was inspected and site access continues to be adequately restricted. All of the major systems within the facility were inspected and in working order. No areas of non-compliance were identified. Groundwater was being extracted from the west extraction well at approximately 140 gallons per minute. Treated water was being discharged to the Seaman Estate Pond at the request of local residents who were concerned that levels within the pond may drop during the remediation. Pond levels are being monitored to ensure they remain constant. Since discharging to the pond, temperature levels have remained more constant (slightly warmer during the winter and cooler during the summer). The cooler pond temperature during the summer months is expected to be favorable to sport fish (i.e. bass) which also pleases local residents. No adverse ecological effects due to temperature changes in the pond water have been observed.

As of the date of the inspection, the network of monitoring wells used to monitor the progress of the pump and treat system as well as ensure its protectiveness remained intact. However, one well outside of the immediate area of concern is no longer operable. Well GW-23 which was located at the corner of Nokomis Road and Route 48, was destroyed by a road construction crew. Figure 3 taken from Hanson Engineers' December 1986 Phase II Site Investigation and Remedial Alternative Development Report has been modified to show GW-23's location. At the request of CIPS, the well will not be replaced. Well GW-23 was the most down gradient well (about 2400 feet southwest of the site) and is not essential to ensure the remedy's protectiveness or completion. On occasion, results from samples taken from GW-23 have indicated the presence of very low levels of semivolatile compounds. Due to the well's location, it is not believed that these compounds are from the site. Contaminants such as those found within GW-23 are common in wells located close to asphalt pavement or other types of roadways.

VII. RECOMMENDATIONS

The pump and treat system is performing as envisioned within the ROD and facility design documents. However, groundwater monitoring data indicates that clean-up objectives have not been met throughout the aquifer. In order to meet the requirements set forth within the ROD and remain protective of human health and the environment, the pump and treat system must continue its current operation.

As discussed within Section V.B, since the completion of the ROD in 1992, an MCL for benzo(a)pyrene was promulgated which is lower than the groundwater clean-up objective set within the ROD. According to the assumptions made within the approved risk assessment for the site, the original groundwater clean-up objective remains protective. Because the original clean-up objective continues to be protective of human health and the environment, no action is recommended.

Additionally, new toxicity data became available for several compounds included as surface water clean-up objectives since the completion of the ROD in 1992. In response, surface water quality standards were re-calculated utilizing any new toxicity information for the contaminants of concern. Illinois EPA considers the new surface water clean-up objectives to be more precise and to more accurately reflect concentrations which will protect human health and the environment. Therefore, Illinois EPA recommends that effluent from the pump and treat facility be required to meet all new standards where the newly calculated standard is lower than that identified within the 1992 ROD as represented within Table 5.

VIII. STATEMENT OF PROTECTIVENESS

The remedy in place continues to be protective of human health and the environment. The excavation and site fencing restricts any surface soil exposures while the pump and treat facility in conjunction with the municipal water line restricts exposure to any contaminated groundwater. Although this five-year review recommends that surface water clean-up objectives be adjusted for the facility's effluent, the existing groundwater treatment operation is providing adequate treatment prior to any surface water discharge.

IX. NEXT REVIEW

The Risk Assessment and existing data do not establish that the levels remaining at the site following the completion of the remedial action will allow unrestricted exposure and unlimited access. Therefore, the Illinois EPA will conduct a Level I five-year review by March 30, 2004.

XI. IMPLEMENTATION REQUIREMENTS

Pursuant to the aforementioned recommendations, surface water clean-up objectives will be updated to confirm that surface water discharges continue to be protective of human health and the environment. It is expected that the change in surface water clean-up objectives will be addressed through an~~d~~ Explanation of Significant Differences to the ROD.

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Table 1 Comparison of Concentrations (μg/kg-wet) of Detected Priority PAHs and Pesticides Found in Fish Tissue Samples Collected from the Seaman Estate Pond in August 1989 August 1997*

Parameter	1989	1990	1991	1992	1993	1994	1995	1996	1997
Largemouth Bass									
Anthracene	<1	2U	20U	34.9	2U	7U	18	6U	10U
Benzo(b)fluoroanthene	<5	1U	20U	**16B**	8U	0.1U	0.3U	0.1U	0.2U
Fluoroanthene	<8	4U	20U	44.4U	**22**	**5**	**1**	**1**	**1B**
Fluorene	6	3U	840U	--†	130U	20U	49U	17U	25U
Dieldrin	--	**239**	40U	8.89U	9U	0.667U	1U	0.667U	1.0U
A-Chlordane	--	8J	**88**	62.4U	11U	0.667U	1U	0.667U	1.0U
4.4'-DDE	--	0J	0J	17.8U	28U	**7.36**	**1.97**	0.667U	1.0U
Endosulfan sulfate	--	787J	0J	295U	40U	1.32	1U	0.667U	1.0U
Bluegill									
4,4'-DDE	--	0J	0J	17.8U	28U	0.667U	**3.11**	0.667U	1.0U
Acenaphthene	<60	**440**	2000U	320U†	144U	180U	403U	133U	200U
A-chlordane	--	0J	60J	62.4U	11U	0.667U	**1.95**	**2.00**	1.0U
Benzo(a)anthracene	<20	**7**	20U	13.3U**	9U	0.1U	0.3U	0.09U	0.1U
Benzo(k)fluoroanthene	6U	0J	0J	4.4U	4U	0.03U	**1**	0.03U	0.1U
Benzo(g,h,i)perylene	<10	5U	20U	8.9U	**17**	0.3U	0.8U1	**1**	0.4U
Chrysene	<3	**2**	20U	--**	7U	2U	6U	2U	3U
Dieldrin	--	0J	10J	8.89U	9U	0.667U	**2.43**	**4.06**	1.0U
Fluoroanthene	<8	**40**	20U	**138**	8U	**4**	**1**	**1**	**1B**
Fluorene	<5	**30**	840U	--†	130U	20U	49U	17U	25U
Indeno(1,2,3-cd)pyrene	<5	2U	20U	26.7U	**18**	0.2U	0.5U	0.2U	0.2U
Phenanthrene	<2	8U	20U	13.3U	**10**	5U	14U	5U	10U
Heptachlor epoxide	--	0J	0J	13.3U	31U	2.66	1.0U	0.667U	1.0U
Benzo(b)fluoroanthene	<5	0J	6J	2.2UB	8U	0.1U	0.3U	0.1U	**0.2**
Channel Catfish									
4,4'-DDE	--	0J	0J	17.8U	28U	0.667U	**4.04**	**1.90**	1.0U
Acenaphthene	<60	**1000**	2000U	320U†	144U	180U	403U	133U	200U
A-chlordane	--	0J	36J	62.4U	11U	0.667U	**7.75**	**7.05**	1.0U
Anthracene	<1	**3**	20U	**30.5**	2U	7U	18U	6U	10U
Benzo(a)anthracene	<20	**9**	20U	13.3U**	9U	0.1U	0.3U	0.09U	0.1U
Benzo(b)fluoroanthene	<5	0J	7.5J	7.7B	8U	0.1U	0.3U	**0.1**	0.2U
Chrysene	<3	**2**	20U	--**	7U	2U	6U	2U	3U
Dieldrin	--	0J	0J	8.89U	9U	0.667U	**4.87**	**2.00**	1.0U
Fluoroanthene	<8	**90**	20U	44.4U	**12**	**8**	**2**	**2**	**2B**
G-Chlordane	--	0J	10J	62.4U	11U	0.667U	6.97	1.98	1.0U
Naphthalene	<30	**40**	2000U	238U	116U	70U	180U	40U	60U
Phenanthrene	<2	**10**	20U	**68.4**	10U	5U	14U	5U	10U

* "J" values are reported for all values from 0 to the practical quantitation limit (PQL). These J values give an estimate of the concentration of the analyte. "U" beside a value indicates that no peak for the analyte was detected with an area greater than the method blank on the chromatogram; this does not mean that it has been confirmed that the analyte is not present, only that it is below the MDL. A "B" beside a value indicates that the analyte was detected in the method blank. Bold type indicates a value greater than the PQL.

† Acenaphthene and fluorene are not separated in 1992; the data reported for 1992 are the sum of both analytes.

** Benzo(a)anthracene and chrysene are not separated in 1992; the data reported for 1992 are the sum of both analytes.

Source: QST, 1997.

Table 2 Detected* Priority PAHs (μg/kg-dry) Found in Sediment Samples Collected from the Seaman Estate Pond in August 1989 through August 1997* (Page 1 of 3)

Parameter	Year	CS1-A	CS1-B	CS1-C	CS4-A	CS4-B	CS4-C	CS6-A	CS6-B	CS6-C
Acenaphthene	1989	--	--	--	--	--	--	--	--	--
	1990	2461	5752	--	--	--	2462	3725	2180	3936
	1991	--	5500	3200	--	--	--	--	--	--
	1992	--	--	--	--	--	--	--	--	--
	1993	--	--	--	--	--	--	--	--	--
	1994	--	--	--	--	--	--	--	--	--
	1995	--	--	--	--	--	--	--	--	--
	1996	15200	10100	16200	10500	7100	20500	5830	3230	12700
	1997	--	--	--	--	--	--	--	--	--
Anthracene	1989	--	--	--	--	--	--	--	--	--
	1990	--	--	--	220	--	--	--	--	--
	1991	--	--	--	12	22	--	--	25	--
	1992	--	--	--	--	23.8	--	--	7.1	--
	1993	--	--	--	--	11	--	--	--	--
	1994	194	197	417	195	207	169	241	302	407
	1995	151	581	288	205	171	101	70.2	250	--
	1996	105	280	179	835	271	205	54.6	311	462
	1997	--	--	--	--	305	--	--	--	--
Benzo(a)anthracene	1989	--	--	--	--	498	--	--	--	--
	1990	--	--	--	--	--	--	--	--	--
	1991	--	50	50	49	87	26	--	81	42
	1992	† --	23.5	714	143	177	50.5	--	--	210
	1993	--	--	--	--	11	--	--	28	22
	1994	52.3	36.9	62.8	53.2	37.4	51.9	38.6	46.3	63.1
	1995	25.5	123	47.7	62.1	29.4	22.5	17.3	31.8	2.30
	1996	91.8	103	81.7	31.2	36.1	33.9	42.4	26.1	40.9
	1997	32.1	43.4	28.5	13.3	39.6	23.3	6.48	37.7	58.7
Benzo(a)pyrene	1989	--	--	--	--	--	--	--	--	--
	1990	--	--	535	--	92	--	--	--	202
	1991	--	90	81	83	150	44	--	110	72
	1992	21.4	21.6	74.5	38.4	86.8	29.3	20.6	29.0	23.7
	1993	--	64	73	85	19	48	--	54	39
	1994	75.4	50.7	89.7	63.4	45.9	63.8	60.0	62.4	82.9
	1995	40.9	217	79.7	68.0	43.6	43.9	26.9	56.7	3.51
	1996	193	218	110	66.1	51.3	54.3	62.0	38.2	64.5
	1997	45.5	59.0	37.2	16.3	53.1	30.4	7.19	46.8	54.8
Benzo(b)fluoroanthene	1989	--	--	--	--	--	--	--	--	--
	1990	--	--	--	--	131	143	--	134	--
	1991	--	170	190	120	200	91	--	180	220
	1992	61.2	129	253	94.7	146	86.5	46.4	69.8	63.7
	1993	45	35	93	106	23	44	--	61	47
	1994	85.0	54.0	106	86.1	64.7	81.4	70.1	726	109
	1995	43.2	221	85.6	75.5	54.5	43.3	33.8	66.3	3.54
	1996	198	200	133	67.0	64.8	60.0	63.1	45.8	75.1
	1997	58.9	67.0	47.2	26.1	70.4	55.8	11.6	59.0	97.5
Benzo(g,h,i)perylene	1989	--	--	--	--	--	--	--	--	--
	1990	--	--	--	--	--	--	--	--	--
	1991	--	140	100	72	87	30	--	99	51
	1992	--	--	--	--	--	--	--	--	--
	1993	--	--	55	--	14	--	--	36	31

Table 2 (continued) Detected* Priority PAHs (μg/kg-dry) Found in Sediment Samples Collected from the Seaman Estate Pond in August 1989 through August 1997* (Page 2 of 3)

Parameter	Year	CS1-A	CS1-B	CS1-C	CS4-A	CS4-B	CS4-C	CS6-A	CS6-B	CS6-C
Benzo(g,h,i)perylene	1994	124	128	128	104	90.5	104	78.2	96.1	134
	1995	74.3	310	120	78.7	62.8	48.5	35.1	80.2	1.87
	1996	201	290	152	70.1	62.8	64.6	70.5	20.0	101
	1997	65.6	109	80.9	26.9	68.4	41.8	15.0	84.6	133
Benzo(k)fluoroanthene	1989	--	--	--	--	--	--	--	--	--
	1990	--	--	--	--	76	--	--	--	--
	1991	--	45	43	39	68	25	--	59	41
	1992	--	--	--	17.9	41.8	17.3	20.1	16.2	17.0
	1993	--	--	--	--	--	--	--	19	--
	1994	40.6	26.1	69.2	38.3	27.2	36.7	36.2	34.2	50.2
	1995	18.5	89.9	35.8	30.6	21.6	20.9	17.6	25.6	1.73
	1996	85.6	96.7	69.9	32.3	29.4	29.3	28.8	15.1	35.2
	1997	26.2	33.5	25.6	10.2	32.3	19.9	4.99	29.3	40.7
Chrysene	1989	--	--	--	--	--	--	--	--	--
	1990	--	--	--	--	84	--	--	--	--
	1991	--	60	58	56	85	44	--	79	47
	1992 †	--	--	--	--	--	--	--	--	--
	1993	--	--	51	78	17	40	--	46	34
	1994	123	102	156	161	84.3	109	74.3	107	162
	1995	10.8	19.4	67.1	39.2	47.8	--	--	--	2.91
	1996	490	553	348	--	170	168	96.2	7.52	189
	1997	28.4	37.4	--	11.2	34.0	27.4	3.80	39.4	31.8
Dibenzo(a,h)anthracene	1989	--	--	--	--	--	--	--	--	--
	1990	--	--	--	--	191	195	353	180	1489
	1991	--	--	--	--	--	--	--	--	--
	1992	--	--	234	--	--	--	--	--	--
	1993	--	--	139	--	14	--	--	--	--
	1994	21.4	20.	23.2	18.4	14.6	17.5	13.4	15.2	24.4
	1995	7.42	45.7	16.1	21.8	5.07	3.91	4.40	7.72	--
	1996	37.5	45.2	17.7	10.7	8.60	7.12	11.6	6.43	10.5
	1997	19.5	16.7	15.5	8.08	--	16.5	3.36	0.60	--
Fluoroanthene	1989	--	--	--	--	1570	--	--	--	--
	1990	--	155	270	--	264	187	--	247	367
	1991	33	220	260	250	400	200	41	360	240
	1992	--	--	--	--	--	--	--	--	--
	1993	74	94	205	149	37	81	37	94	67
	1994	109	74.6	139	137	85.2	113	97.2	96.9	140
	1995	60.1	284	110	149	90.5	83.7	58.0	90.6	8.14
	1996	225	218	211	96.5	89.2	92.1	77.6	48.7	106
	1997	77.3	90.6	99.7	41.3	99.9	74.9	22.1	81.2	145
Fluorene	1989	--	--	--	--	--	--	--	--	--
	1990	--	--	--	--	--	--	--	--	--
	1991	--	--	--	--	--	--	--	--	--
	1992	--	--	--	--	--	--	--	--	--
	1993	--	--	--	--	--	--	--	--	--

Table 2 (continued) Detected* Priority PAHs (μg/kg-dry) Found in Sediment Samples Collected from the Seaman Estate Pond in August 1989 through August 1997* (Page 3 of 3)

Parameter	Year	CS1-A	CS1-B	CS1-C	CS4-A	CS4-B	CS4-C	CS6-A	CS6-B	CS6-C
Fluorene	1994	1370	485	1170	2320	597	779	3700	651	937
	1995	5430	1620	1130	9670	3780	1230	2800	577	177
	1996	--	--	--	--	--	--	--	--	--
	1997	1240	689	1250	987	2450	1530	287	1400	910
Indeno(1,2,3-cd)pyrene	1989	--	--	--	--	--	--	--	--	--
	1990	--	--	--	--	127	129	--	--	--
	1991	--	160	170	150	240	94	--	210	140
	1992	--	--	--	--	--	--	--	--	--
	1993	--	--	--	--	--	--	--	--	--
	1994	67.4	83.0	107	90.4	61.9	72.3	73.8	82.5	99.2
	1995	49.7	151	57.4	48.6	32.1	34.1	22.1	42.5	--
	1996	237	256	161	85.0	73.2	67.5	83.2	68.5	117
	1997	39.3	51.7	41.4	16.4	44.8	20.3	8.51	43.2	68.4
Naphthalene	1989	--	--	--	--	--	--	--	--	--
	1990	--	--	--	--	--	--	--	--	--
	1991	--	--	--	--	--	--	--	--	--
	1992	--	--	--	--	--	--	--	--	--
	1993	--	--	--	--	--	--	--	--	--
	1994	492	181	431	808	255	283	1370	229	241U
	1995	2700	1280	781	277	1770	663	1300	424	148
	1996	532	340	417	350	205	535	201	--	337
	1997	594	338	524	508	588	645	--	--	--
Phenanthrene	1989	--	--	--	--	755	--	--	--	--
	1990	--	--	--	--	121	110	261	131	383
	1991	--	--	43	60	99	50	--	86	36
	1992	55.8	53.7	231	--	155	40.9	33.1	86.3	66.9
	1993	74	62	99	135	60	117	19	84	44
	1994	1120	215	533	2640	254	410	511	318	278
	1995	189	605	249	691	289	484	128	347	26.2
	1996	280	336	362	3160	995	806	440	364	1110
	1997	305	124	31.3	52.8	151	198	--	592	244
Pyrene	1989	--	--	--	--	746	--	--	--	--
	1990	--	--	--	--	182	121	--	157	298
	1991	--	120	120	140	220	69	--	210	110
	1992	--	89.9	--	--	197	--	--	64.3	--
	1993	2220	2080	1850	4360	1040	1130	401	790	1350
	1994	291	189	373	453	158	246	256	254	341
	1995	111	811	346	317	220	242	119	240	10.6
	1996	105	96.8	50.7	26.2	82.8	110	22.7	15.3	90.2
	1997	137	122	77.8	45.1	124	101	16.0	104	157

* Only those PAHs above the PQL/MDL. See individual study year reports for details pertaining to PQL/MDL data.

† Benzo(a)anthracene and chrysene are not separated in 1992; the data reported are the sum of benzo(a)anthracene and chrysene.

Source: QST, 1997.

Table 3 Comparison of Concentrations (μg/L) of Detected Priority PAHs found in Water Samples Collected from the Seaman Estate Pond in August 1989 through August 1997*

Parameter	1989	1990	1991	1992	1993	1994	1995	1996	1997
CS1-B									
Acenaphthene	<0.6444	**0.553**	10U	1.5U†	1.44U	2.22U	2.02U	2.00U	2.00U
Anthracene	<0.013	0.010U	0.1U	**0.02J**	0.02U	0.089U	0.089U	0.089U	0.099U
Benzo(b)fluoranthene	<0.047	0.007U	0.1U	0.01U	0.08U	0.001U	0.002U	0.001U	0.002U
Benzo(k)fluoranthene	<0.063	0.007U	0.1U	0.02U	0.04U	0.0004U	0.0004U	0.0004U	0.001U
Fluoranthene	**0.915**	**0.039**	0.1U	0.2U	0.08U	**0.006**	**0.010**	**0.009**	**0.015B**
Naphthalene	<0.254	**0.097**	10U	1.1U	1.16U	0.917U	0.899U	0.596U	0.601U
Phenanthrene	<0.023	0.040U	0.1U	**0.09JB**	0.10U	0.065U	0.072U	0.072U	0.074U
CS4-B									
Acenaphthene	<0.6444	**0.547**	10U	1.5U†	1.44U	2.22U	2.02U	2.00U	2.00U
Anthracene	<0.013	0.010U	0.1U	0.01U	0.02U	0.089U	0.089U	0.089U	0.99U
Benzo(b)fluoranthene	<0.047	0.007U	0.1U	**0.2**	0.08U	0.001U	**0.012**	0.001U	0.002U
Benzo(k)fluoranthene	<0.063	0.007U	0.1U	0.05J	0.04U	0.0004U	**0.006**	0.0004U	0.001U
Fluoranthene	**0.315**	**0.023**	0.1U	0.2U	0.08U	**0.006**	**0.027**	**0.008**	**0.021B**
Naphthalene	<0.254	**0.132**	10U	1.1U	1.16U	0.917U	0.899U	0.596U	0.601U
Phenanthrene	<0.023U	0.040U	0.1U	0.1B	0.10U	0.065U	0.072U	0.072U	0.074U

* "J" values are reported for all values from 0 to the practical quantitation limit (PQL). These J values give an estimate of the concentration of the analyte. "U" beside a value indicates that no peak for the analyte was detected with an area greater than the method blank on the chromatogram; this does not mean that it has been confirmed that the analyte is not present, only that it is below the MDL. "B" indicates the analyte was detected in the method blank.

† Acenaphthene and fluorene were not separated in 1992, the reported data are the sum of both analytes.

Source: QST, 1997.

Table 4

GROUND WATER RESTORATION OBJECTIVES
CIPS - GAS PLANT SITE
TAYLORVILLE, ILLINOIS

Chemical	CAS Number	Daily Maximum Concentration Discharge to S. Fork Sangamon River NPDES Discharge Limits (ug/l)	Maximum Concentration Discharge Limits to S. Fork Sangamon River NPDES Discharge Limits Avg./Daily Max. (ug/l)	Cleanup Objectives for Class I Ground Water (ug/l)	ADL (ug/l)
<u>Carcinogenic PNAs</u>					
Benzo(a)anthracene	56553	1	--	.13	.13
Benzo(a)pyrene	50328	.05	--	.23	.23
Benzo(b)fluoranthene	205992	--	--	.18	.18
Chrysene	218019	--	--	.15	.15
Dibenzo(a,h)anthracene	53703	--	--	.3	.3
<u>Non-Carcinogenic PNAs</u>					
Acenaphthene	83329	60.8	--	420(2)	10
Anthracene	120127	2.3	--	2,100	6.6
Benzo(k)fluoranthene	207089	--	--	.17	.17
Fluoranthene	206440	398	--	280(2)	2.1
Fluorene	86737	--	--	280(2)	2.1
Indeno(1,2,3-c,d)pyrene	193395	--	--	.43	.43
Naphthalene	91203	790	53/670	25	.6
Pyrene	129000	--	--	210(2)	2.7

Table 4

GROUND WATER RESTORATION OBJECTIVES
CIPS - GAS PLANT SITE
TAYLORVILLE, ILLINOIS

(Cont.)

Chemical	CAS Number	Daily Maximum Concentration Discharge to S. Fork Sangamon River NPDES Discharge Limits (ug/l)	Maximum Concentration Discharge Limits to S. Fork Sangamon River NPDES Discharge Limits Avg./Daily Max. (ug/l)	Cleanup Objectives for Class I Ground Water (ug/l)	ADL (ug/l)
<u>Other Non-Carcinogenic PNAs Total</u>			--	210	
Acenaphthylene	208968	--	--	--	10
Benzo(g,h,i)perylene	191242	--	--	--	.76
Phenanthrene	85018	10	--	--	6.4
Total PNAs (except Naphthalene)		--	--/100	--	--
Total Phenols	--	100	100/200	100	--
Toluene	108883	2,400	70/750	1,000	2
Benzene	71432	2,200	--/50	5	2
Ethylbenzene	100414	3,200	17/216	700	2
t-1,2 Dichloroethene	156605	14,000	--	100	5
Dichloromethane	75092	19,300	--	.2[3]	0.2
Bromoform	75252	--	--	.2	0.2
Xylenes	1330207	2,090	117/750	10,000	2
2-Methylphenol	95487	1,900	--	350[1]	10

Table 4

GROUND WATER RESTORATION OBJECTIVES
CIPS - GAS PLANT SITE
TAYLORVILLE, ILLINOIS

(Cont.)

Chemical	CAS Number	Daily Maximum Concentration Discharge to S. Fork Sangamon River NPDES Discharge Limits (ug/l)	Maximum Concentration Discharge Limits to S. Fork Sangamon River NPDES Discharge Limits Avg./Daily Max. (ug/l)	Cleanup Objectives for Class I Ground Water (ug/l)	ADL (ug/l)
4-Methylphenol	106445	1,900	--	350(1)	10
Di-n-butyl phthalate	84742	73	--	700	3.3
Bis (2-ethylhexyl) phthalate	117817	--	--	2.7(3)	2.7
NOEC		≥100% Effluent	--	--	--
Dissolved Iron	15438310	--	-/1000	--	--
Total Iron	15438310	--	2000/4000	500	--
pH		--	6.0-9.0	6.5-9.0	--

Notes: Discharge Limits as per table 13 in the Record of Decision.

Objectives Basis: 35 IAC 620 Subpart F and Subpart B:

Title 35:	Environmental Protection
Subpart F:	Public Water Supplies
Subpart F:	Health Advisories
Subpart B:	General Use Water Quality Standards

The Nondegradation provisions of 35 IAC 620 Subpart C may also be applicable at this site.

NOEC. No observable effect concentration based on chronic toxicity test.

Table 4

GROUND WATER RESTORATION OBJECTIVES
CIPS - GAS PLANT SITE
TAYLORVILLE, ILLINOIS

(Cont.)

ADL: Acceptable detection Limit; lowest Practical Quantitation Limit (PQL) from SW846.

(1) Sum of concentrations of 2-methylphenol plus 4-methylphenol is not to exceed 350 ug/l.

(2) In addition to meeting the individual Class I ground water/objectives indicated above, the following equation must be satisfied to protect against liver, kidney, and blood toxicity.

$$\frac{[\text{acenaphthene}]}{420\ \text{ug/l}} + \frac{[\text{fluoranthene}]}{280\ \text{ug/l}} + \frac{[\text{fluorene}]}{280\ \text{ug/l}} + \frac{[\text{pyrene}]}{210\ \text{ug/l}} \leq 1$$

Where [ ] denotes concentration in ug/l.

(3) In addition to meeting the individual Class I ground water objectives indicated above, the following equation must be satisfied to protect against liver tumors.

$$\frac{[\text{dichloromethane}]}{0.2\ \text{ug/l}} + \frac{[\text{bis(2-ethylhexyl)phthalate}]}{2.7\ \text{ug/l}} \leq 1$$

Where [ ] denotes concentration in ug/l.

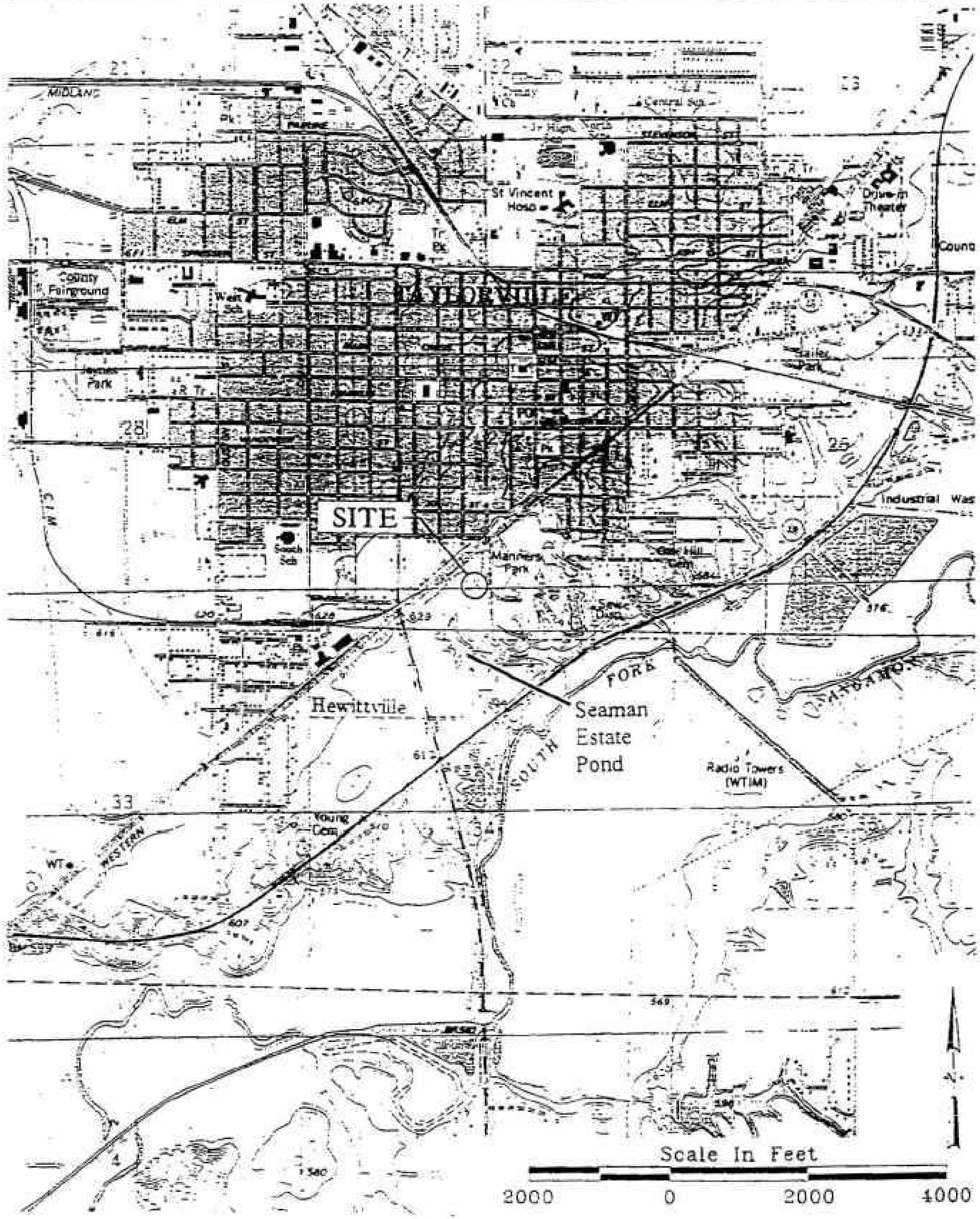
Table 5
Maximum Allowable Concentrations for Surface Water

Compound	CAS Number	ROD Standard		New Standards for Consideration		
		Protection of Aquatic Life in ug/L[1]	Protection of Aquatic Life and Technology Based Standards in ug/L[2]	Protection of Aquatic Life in ug/L		Protection of Human Health for Fish Consumption in ug/L
		Acute	Average/Maximum	Acute	Chronic	
Acenaphthene	83329	60.8		120	62	880
Acenaphthylene	208968			190[3]	15[3]	--
Anthracene	120127	2.3		--	--	35,000
Benzene	71432	2,200	--/50[4]	1,300	1,300	21
Benzo(a)anthracene	56553	1		--	--	--
Benzo(a)pyrene	50328	0.5		--	--	0.16
Benzo(b)fluoranthene	205992			--	--	0.16
Benzo(k)fluoranthene	207089			--	--	1.6
Bis (2 ethyl hexyl phthalate)	117817			--	--	1.9
Bromoform	75252			--	--	100
Dibenzo(a,h)anthracene	53703			--	--	0.16
Di-n-butyl phthalte	84742	73		--	--	3,800
t-1,2-dichioroethene	540590	14,000		14,000[3]	1,100	--
Dichloromethane	75092	19,300		17,000	1,400	340
Ethyl benzene	100414	3,200	17[5]/216[5]	220	17	9,300
Fluoranthene	206440	398		--	--	120
Fluorene	86737			--	--	4,500
Iron	15438310			--	1000[6]	--
Indeno(1,2,3-cd)pyrene	193395			--	--	0.16

Table 5 (continued)
Maximum Allowable Concentrations for Surface Water

Compound	CAS Number	ROD Standard		New Standards for Consideration		
		Protection of Aquatic Life in ug/L[1]	Protection of Aquatic Life and Technology Based Standards in ug/L[2]	Protection of Aquatic Life in ug/L		Protection of Human Health for Fish Consumption in ug/L
		Acute	Average/Maximum	Acute	Chronic	
2-Methyl phenol	95487	1,900		4,700	370	18,000
4-Methyl phenol	106445	1,900		670	1250	--
Naphthalene	91203	790	53[5]/670[5]	510	68	--
Phenanthrene	85018	10		46	3.7	--
Phenol	108950	100		100	100	--
Pyrene	129000			--	--	3,500
Toluene	108883	2,400	70[5]/750[4]	1,300	110	62,000
Xylene	1330207	2,090	117[5]/750[4]	1,500	120	62,000
Total PNAs except Naphthalene			--/100[4]	--	--	--
Total Phenols			100[6]/200[6]	100[6]	--	--
pH			6-9[6]			
Total Iron			2000[6]/4000[6]			
Dissolved Iron			--/1000[6]			
NOEC		> 100% effluent				

1. Pump and Treat System discharge limits based on protection of aquatic life in receiving water.
2. Surface Water Clean-up Objectives and effluent limits based on either protection of aquatic life or the lowest level which can be reasonably achieved using best available technology.
3. Technology based standard in consideration of best professional judgement of the best available treatment technology.
4. Water Quality criteria calculated utilizing toxicity data from literature for protection of aquatic life.
5. Numeric Standard from Illinois Surface Water Quality regulations.
6. Advisory standard. Not calculated according to Illinois Surface Water Quality regulations.



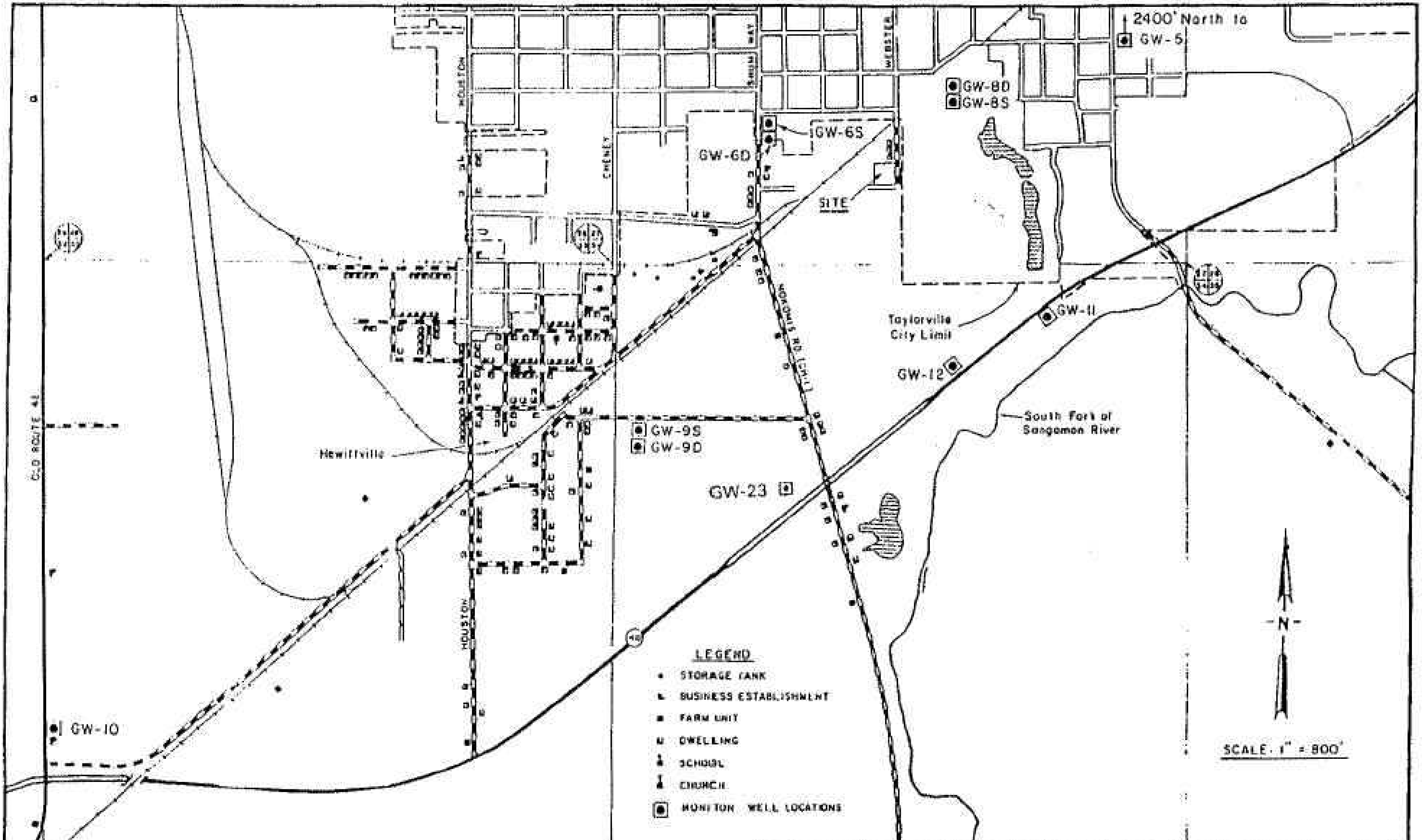
SITE LOCATION MAP

HANSON ENGINEERS

CQCP-
CIPS – GAS PLANT SITE
TAYLORVILLE, ILLINOIS

Job No. 85S3086T

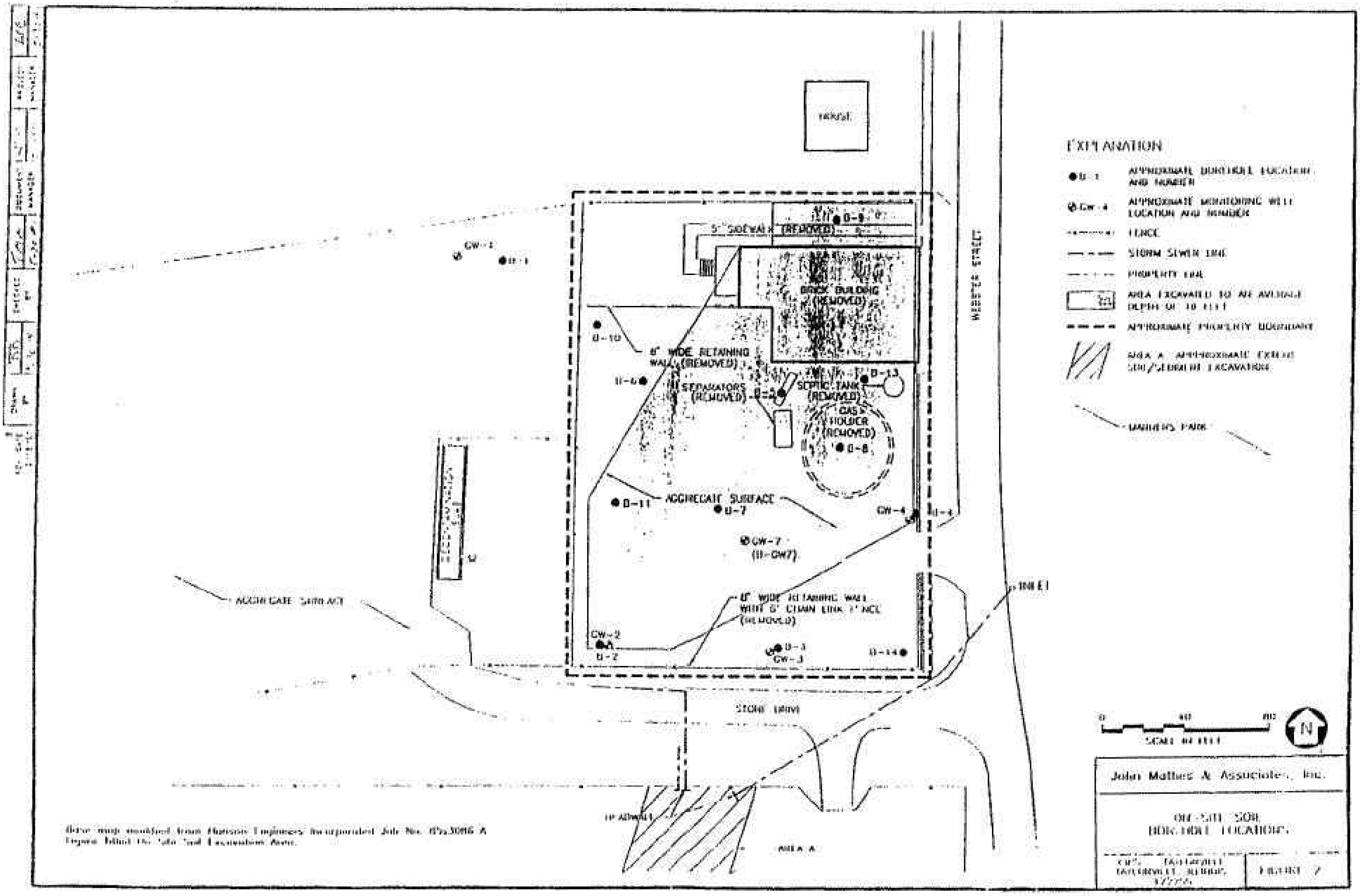
Figure 1



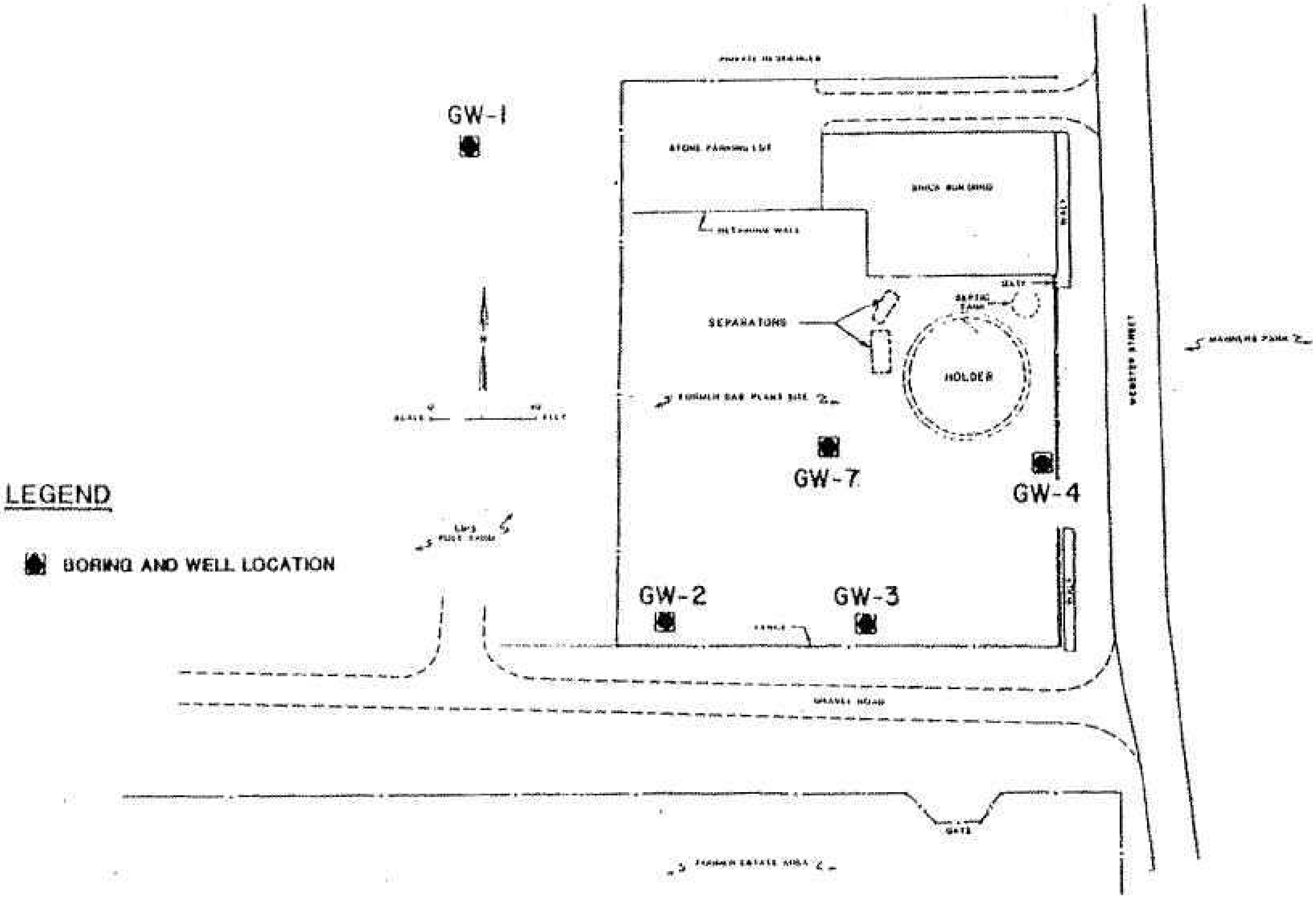
AREA MONITOR WELL LOCATIONS

Gas Plant Site
C.I.P.S.
Taylorville, Illinois

Job No. 85S3086A Figure 3



HOUSE
EXPLANATION
FENCE
STORM SEWER LINE
PROPERTY LINE
APPROXIMATE PROPERTY BOUNDARY
5' SIDEWALK (REMOVED)
BRICK BUILDING (REMOVED)
8" WIDE RETAINING WALL (REMOVED)
SEPARATORS (REMOVED)
SEPTIC TANK (REMOVED)
GAS HOLDER (REMOVED)
AGGREGATE SURFACE
8" WIDE RETAINING WALL WITH 6' CHAIN LINK FENCE (REMOVED)
GW-1
B-1
B-2
GW-2
B-3
GW-3
GW-4
B-6
B-7
B-8
B-9
B-10
B-11
B-13
B-14
GW-7
(B-GW7)
STONE DRIVE
INLET
AREA A
SCALE IN FEET
N
John Mathes & Associates, Inc.
ON-SITE SOIL
BORING LOCATIONS



SITE MONITOR WELL LOCATIONS

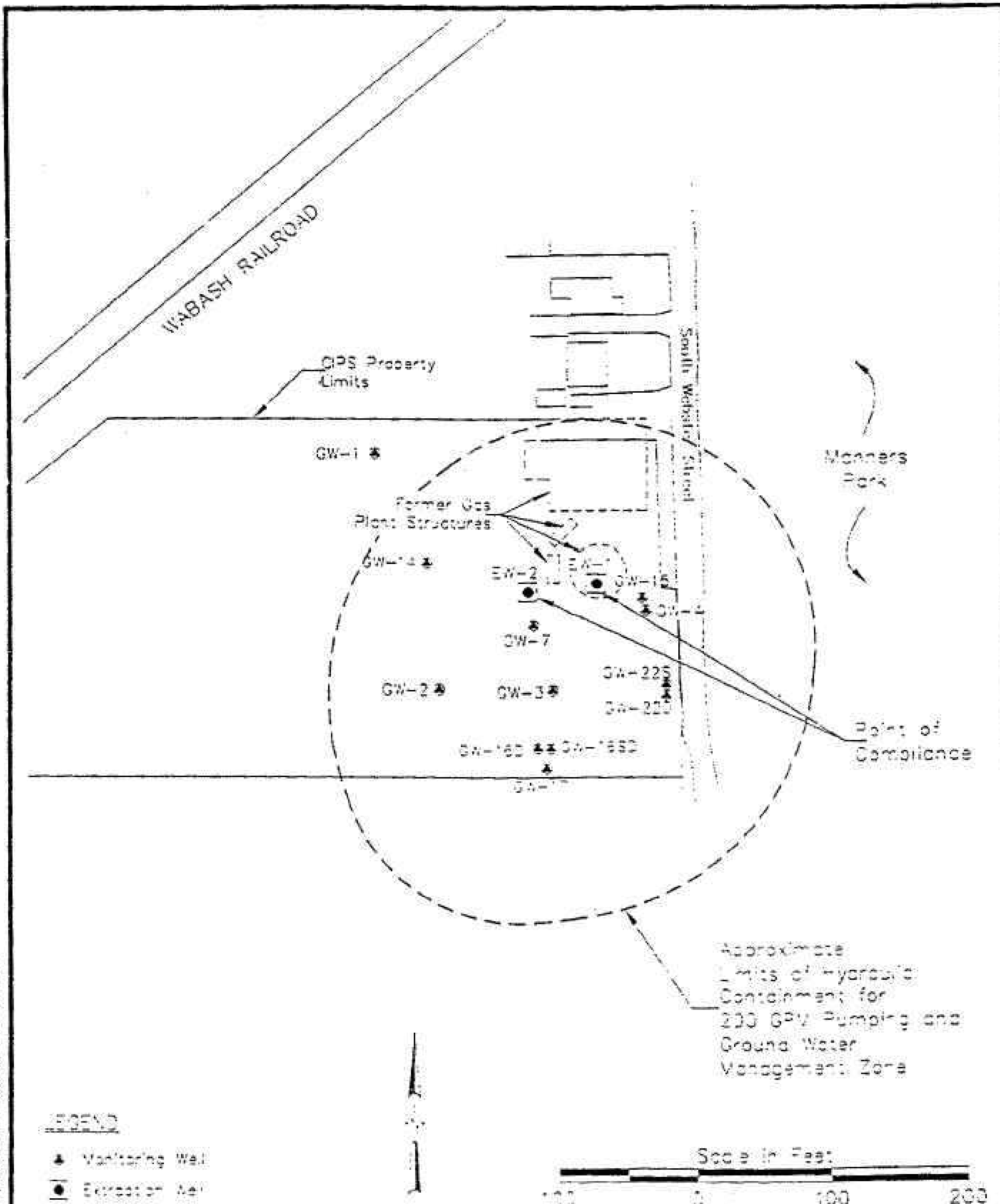
HANSON ENGINEERS

SPRINGFIELD, IL • PEORIA, IL • ROCKFORD, IL

Gas Plant Site
C.I.P.S.
Taylorville, Illinois

Job No. 85S308GA

Figure 4



DELINEATION OF GMZ

HANSON ENGINEERS INCORPORATED

CQCP
CIPS – GAS PLANT SITE
TAYLORVILLE, ILLINOIS

Job No. 85S3086T

Figure 5